CLAIMS

1. A dynamically tunable thin film interference coating including one or more layers with thermo-optically tunable refractive index.

2. The dynamically tunable thin film interference coating of claim 1, where the one or more thermo-optic layers are semiconductor materials.

3. The dynamically tunable thin film interference coating of claim 2, where the semiconductor materials are directly-deposited materials.

4. The dynamically tunable thin film interference coating of claim 3, where the directly-deposited semiconductor materials are expitaxially-grown single-crystal layers.

5. The dynamically tunable thin film interference coating of claim 3, where the directly-deposited materials are non-crystalline semiconductors.

6. The dynamically tunable thin film interference coating of claim 5, where the non-crystalline semiconductors are in an amorphous state.

7. The dynamically tunable thin film interference coating of claim 6, where the amorphous semiconductor is amorphous silicon or amorphous silicon germanium.

8. The dynamically tunable thin film interference coating of claim 7, where the amorphous silicon or amorphous silicon germanium is deposited using plasma-enhanced chemical vapor deposition.

9. The dynamically tunable thin film interference coating of claim 5, where the non-crystalline semiconductors are microcrystalline materials.

10. The dynamically tunable thin film interference coating of claim 5, where the non-crystalline semiconductors are polycrystalline materials.

11. The dynamically tunable thin film interference coating of claim 10, where the polycrystalline semiconductor materials are directly deposited as amorphous or microcrystalline material and then recrystallized to polycrystalline state.

12. The dynamically tunable thin film interference coating of claim 1, where a heating element is integrated with the tunable thin films.

13. The dynamically tunable thin film interference coating of claim 12, where the heating element includes one or more optically-absorbing layers and heating is achieved through an optical signal.

14. The dynamically tunable thin film interference coating of claim 12, where the heating element is a resistive electrical heater.

15. The dynamically tunable thin film interference coating of claim 14, where the heating element is an integrated as layer in the optical thin film structure.

16. The dynamically tunable thin film interference coating of claim 15, where the heating element is a doped region in a crystalline semiconductor substrate.

17. The dynamically tunable thin film interference coating of claim 15, where the heating element is a directly-deposited transparent metallic oxide.

18. The dynamically tunable thin film interference coating of claim 15, where the heating element is a directly-deposited doped thin film semiconductors.

19. The dynamically tunable thin film interference coating of claim 15, where the heating element is a bulk recrystallized doped polycrystalline semiconductor.

20. The dynamically tunable thin film interference coating of claim 1, where this coating is used to dynamically vary optical power transmission, reflection, or absorption as a function of optical wavelength.

21. The dynamically tunable thin film interference coating of claim 20, where this coating is used as a dynamically tunable optical bandpass filter.

22. The dynamically tunable thin film interference coating of claim 21, where this coating contains a single thermo-optically tunable optical cavity determining transmitted wavelength Fabry-Perot filter.

23. The dynamically tunable thin film interference coating of claim 21, where this coating contains multiple thermo-optically tunable optical cavities determining transmitted wavelength.

24. The dynamically tunable thin film interference coating of claim 21, where this coating is used as a part of a wavelength-tunable optical detector.

25. The dynamically tunable thin film interference coating of claim 24, where this coating is used in a scanning optical spectrometer.

26. The dynamically tunable thin film interference coating of claim 21, where this coating is used as a tunable add-drop filter for optical communications.

27. The dynamically tunable thin film interference coating of claim 20, where this coating is used to vary relative transmission or reflection per wavelength over a range of wavelengths.

28. The dynamically tunable thin film interference coating of claim 27, where this coating is used as part of a spectral equalizer or spectral filter that is tunable over a range of wavelengths.

29. The dynamically tunable thin film interference coating of claim 20, where this coating is used to vary overall transmission or reflection over a range of wavelengths.

30. The dynamically tunable thin film interference coating of claim 29, where this coating is used as part of a variable optical attenuator where loss is tunable over a range of wavelengths.

31. The dynamically tunable thin film interference coating of claim 1, where this coating is used to dynamically vary optical phase as a function of wavelength in reflection or transmission.

32. The dynamically tunable thin film interference coating of claim 31, where this coating is used to dynamically control chromatic dispersion in an optical communications system.